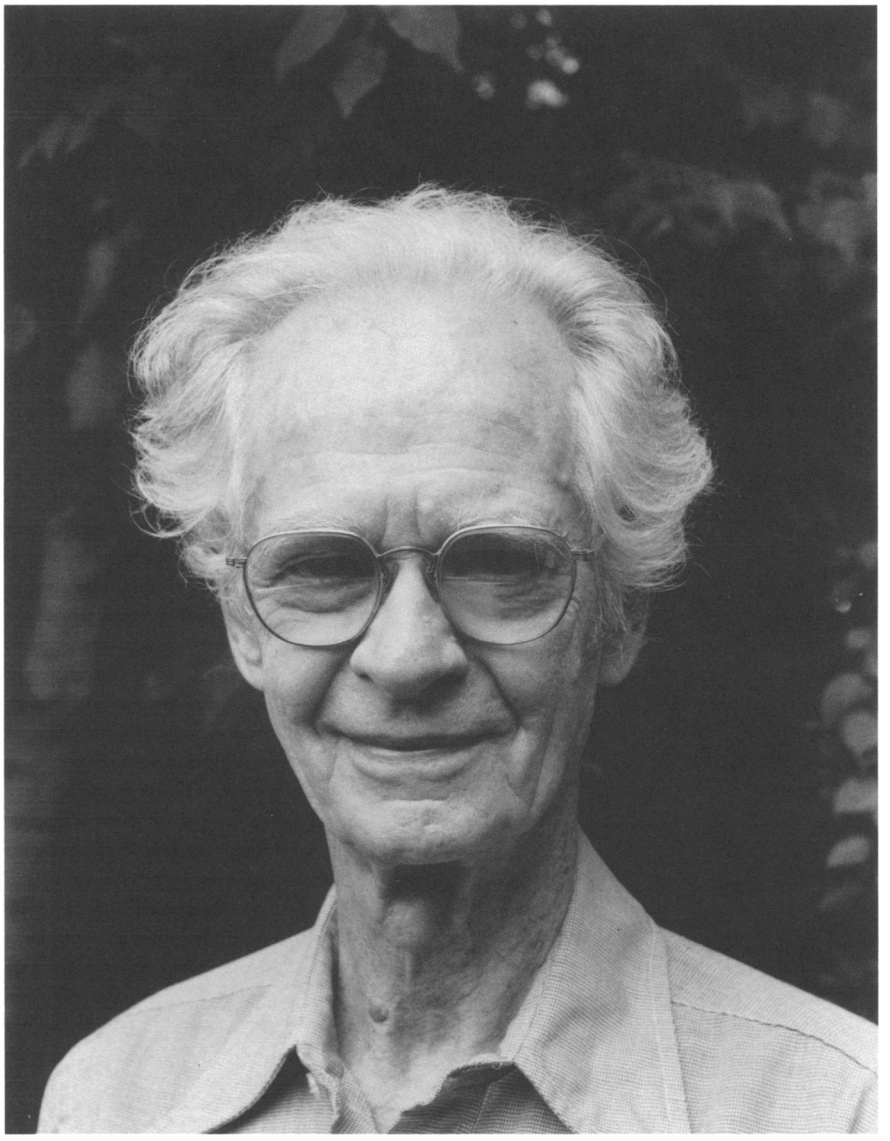

JEAB's intellectual debt to B. F. Skinner (1904–1990) cannot be overstated. We are delighted that his longtime friend and colleague, Fred S. Keller, responded so graciously and promptly to my request for an appreciation. It is fitting that these comments appear with our Special Issue on Human Operant Behavior. As noted in our preface to this issue, research with human subjects is a vital complement to research with nonhuman subjects. We hope that the significance and breadth of the exciting research reported in this issue serve as a further testimonial to the enduring and expanding impact of B. F. Skinner's work.

Edmund Fantino

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BURRHUS FREDERIC SKINNER (1904–1990) (A THANK-YOU)

B. F. Skinner, America's pre-eminent psychologist, who studied human and animal behavior in ingenious experiments and hoped that his findings would foster creativity and curtail repression, died Saturday at Mount Auburn Hospital in Cambridge, Mass. He was 86 years old and lived in Cambridge.

The above is the opening paragraph of a full-page summary of the life and works of Burrhus Frederic Skinner,[1] as printed in the obituary section of *The New York Times* for Monday, August 20th, of this year. The entire account is an excellent biographical treatment of Fred Skinner's life, from its beginnings in the little railroad town of Susquehanna, Pennsylvania, until the time of his last appearance before his friends and colleagues at the Boston meetings of the American Psychological Association eight days before he died.

The article tells of his education at Hamilton College, in upper New York State; of his graduate study at Harvard from 1928 to 1931; of his later research there with National Research Council aid and as a member of Harvard's Society of Fellows; of his first position as a teacher at the University of Minnesota; of his chairmanship at Indiana; and, finally, of his return to Harvard in 1948, to become Edgar Pierce Professor of Psychology 10 years later, and to retire from active teaching in 1974 with Emeritus status.

The author of the *Times* report, Dava Sobel, was well informed about her subject. She covers several of Skinner's major contributions to our science, basic and applied, including a good account of his rejected contribution to our wartime effort, Project Pigeon, and she quotes at length from some of his writings (the theoretical are understandably neglected). She lists most of his important books, including the first two volumes of the autobiography, and she mentions three of his inventions: the Skinner Box, the Baby Tender, and the Teaching Machine. She even notes his boyhood plans for a water-powered perpetual-motion device and his 1937 tour de force with Pliny the Elder at the Minnesota meetings of the American Psychological Association, as well as the much more recent "Columban simulations" in which pigeons served as subjects.

She didn't mention all of Fred's creations, practical or for amusement, that he made as a boy in Susquehanna; there were model ships he made to sell in Scranton, where his parents were living when he returned from college; puppets that he made for the children of a Harvard Medical School professor; a kite he made for my daughter, Anne, when he came to visit us one summer; a ring-the-nail game on the front porch of The Trailing Yew on Monhegan Island, where one could test his skill in rainy weather, when there was nothing else to do; and there was a double-alternation maze that he invented to aid me in my doctoral research—a maze that would let my animals practice day and night without the need for handling, but which was never mastered by my rats.

The readers of *JEAB* and *JABA* will find nothing new in the *Times* report (or in others[2])—nothing that they haven't read in Fred Skinner's own accounts—but they will find a very welcome positive treatment and a recognition of his genius, rather than tongue-in-cheek acclaim or gross distortion.

Predictably, because of its readership, the emphasis of the *Times* report is on the applications of our science to matters of general

[1] B. Frederic Skinner was the name with which he started life; everyone called him Fred in college, in graduate school, and later. When I discovered that while at Hamilton he was once called Burrhus de Beerhus (his mother's maiden name was Burrhus), it caught my fancy. I pictured him on horseback, in armor, with a lance and pennon. Also, I saw an answer to the problem of two Freds within a closely associated group of graduate students. Except with Burrhus (sic!) himself, this was unsuccessful. So, in deference to my colleagues, I use Fred in this account; but whenever I type *Fred,* I've just said *Burrhus*!

[2] Since this was written, I have received a number of newspaper versions of Fred's life and works, including two good treatments in the *Boston Globe* for August 20th which merit comment that I cannot give them here. In these reports and others, I have been impressed by the positive impact of his teachings, even when he was in life a subject of much controversy.

concern—child rearing, the teaching of retardates, programmed learning, cultural design, and the guided missile, for example. *The Behavior of Organisms* is mentioned only in connection with reinforcement schedules—"such as the piece-work rate of pay in industry."

Because the obituaries have been published and Fred's autobiography[3] is well known to the readers of this journal, there is little that I can add beyond a personal expression, an appreciation of the man who meant more to me, on three main counts, than any other in my lifetime, beginning in the decade of the twenties when we were graduate students together.

We were an odd couple. Fred came to Harvard in 1928 with an enviable record of achievement, from grade school on. At Hamilton College he had obtained not only a first-class liberal education through his course work but had also enjoyed a close relationship with one of his professors in whose home he was a tutor, where his budding intellect was given play and his tastes were sharpened in both literature and music. After college he had undergone a period of *Sturm und Drang*: He had studied to be a writer at the Breadloaf Conference at Middlebury College, had tasted life in Greenwich Village, and had traveled abroad to Italy (mainly Tivoli and Rome), returning by way of Paris. Having decided against a career of writing, he had picked psychology, for which his preparation, I believe, amounted to some reading of René Descartes, Jacques Loeb, Ivan Pavlov, Bertrand Russell, John B. Watson, and H. G. Wells.

I arrived at Harvard, on the other hand, with inferior early schooling, a year of employment as a journeyman telegrapher, 18 months of military service (14 in the A.E.F.), with a subsequent C-grade performance in a preparatory school and my first four years of college (Tufts). This had been followed by a year of work in a printing-publishing establishment in Andover, Massachusetts, a marriage, and a return to Tufts for another year, in which I was to fulfill my course requirements for a bachelor's degree and to prepare for graduate study in psychology and a Tufts instructorship, each on a half-time basis. This return had been initiated by my reading of John Watson's *Psychology from the Standpoint of a Behaviorist,* and, by 1928, I had read everything that he had written and had used his text, *Behavior,* in my Tufts course in Comparative Psychology.

When Fred reached Harvard with his behavioristic leanings, I was the only kindred spirit in the graduate group and there were no behaviorists of any kind on the teaching staff. As soon as we discovered our common bias, we joined forces and, during the next three years, we came to be close friends.

At first we seldom saw each other. He spent much of his time in the Physiology Department, and I was commuting to Medford Hillside almost daily. But when I left Tufts to become a Harvard tutor in 1929, when our animal laboratory was moved from Emerson to Boylston Hall (where Fred and I were given space: "exiled," he wrote later), and when he took rooms in the same apartment house as the one to which my wife and I had moved, our relationship was cemented. Gradually he became not only a close friend, but also a counselor and mentor. Although four years my junior, he was older than I in many ways, and I recognized his genius early. When he was wavering between a career in physiology or in psychology, I urged him to remain within the latter field, where I saw a brilliant future for him.

Fred followed closely my experimental research on the double-alternation problem, for which I had no functional Harvard sponsor.[4] After 10 months of daily data collection, when I had to complete my doctoral dissertation in the early morning hours of its due date, he probably saved my PhD for me by his critical reading, page by page throughout the night, of the document as I put it in its final form. Without his friendship and support, I should probably not have reached my goal within that year or even be writing this today.

Students of psychology in the twenties were well acquainted with the "schools." Structuralism, functionalism, behaviorism, and Ge-

[3] A biography is currently in process by Daniel W. Bjork, author of *William James—The center of his vision.* (New York: Columbia University Press, 1988.)

[4] My interest in this area of animal research had been aroused when Walter S. Hunter, then at Clark University and a recognized behaviorist, was a visitor at Harvard in 1929.

stalt were commonly treated in our classes, with psychoanalysis occasionally included. By the late thirties, however, the talk was shifting to "learning theories," and the positions of E. R. Guthrie, Clark L. Hull, Kurt Lewin, and E. C. Tolman were most often covered. In 1938, Fred Skinner's name was added. The reason: *The Behavior of Organisms,* a book that would change the course of many careers, including my own, throughout the years to come.

The *B of O,* as we came to call it at Columbia, brought together all of Fred's researches (I counted many in its pages) and the fruits of all his study within a systematic treatise that I have always felt to be his greatest work, in part because it led to thousands of experiments in countless laboratories of the world; in part because so much of his later writing seems a natural extension of its message; and in part because the experiments described within it were carried out on individual organisms and could easily be repeated with the same results by other workers. The veriest beginner in an undergraduate laboratory could confirm the lawfulness of animal behavior by himself ... and might never be the same thereafter!

There are other things that I could say about the *B of O*—about its integration of Sherringtonian, Pavlovian, Watsonian, and Thorndikian conceptions; about its reflection of his Harvard teachings; and about its careful objectivity and its freedom from persuasive tricks or emotional appeal. Fred could write poetically and convincingly, but he scorned to do so in the *B of O.* "Just the facts, Ma'am," and facts there were in plenty.

The third of my principal reasons to be grateful to Fred Skinner, and the last to be included here, is concerned with educational reform—more specifically with the *teaching machine* and its counterpart, *programmed instruction.* As in the case of the *B of O,* this development altered my perspective and changed the nature of my work for almost 20 years.

Fred wrote about this machine and its employment in 1954, in a paper on "The Science of Learning and the Art of Teaching" for the *Harvard Educational Review.* In that article he related the experimental study of behavior, as described in the *B of O,* to the preparation of educational material and the improvement of educational practice. He proposed to individualize instruction in the classroom with the aid of a machine and the program it contained, which would permit a student to advance, step by small step and painlessly, through a course of study, at his own pace, from ignorance to knowledge of its subject matter. In 1958 he followed this with an article in *Science,* wherein he described in some detail a machine that he had used with Harvard students, together with a sample of its program.

Many others were soon attracted to the new departure, and a number of machines and programs appeared. It seemed clear to me that a movement was beginning, and my response to it was enthusiastic. I talked about it in my classes (announcing that lectures would soon be out of date) and I used a senior seminar to explore the matter further, calling on each member to write a program of his own. I gave some outside lectures on the subject, too, and visited several universities or colleges with my message (including Hamilton, where it was well received). On two occasions I nearly left Columbia to participate in governmentally funded projects in which the development and large-scale use of programmed teaching were involved. In 1961, the year in which the Holland-Skinner programmed text[5] was published, I introduced the new idea in Brazil, at the University of São Paulo, where the book itself was soon translated into Portuguese.

In 1964 a self-paced, nonpunitive, but mastery-oriented laboratory course in the analysis of behavior, rooted in programmed instruction and the *B of O,* was successfully introduced at the University of Brasília, as the first one of a series (also self-paced) leading to the PhD. A university-wide debacle stopped the project, but a different version of that introduction was brought to the United States in 1965, where it soon showed great promise in the hands of many teachers. It has failed as yet to overthrow the 17th-century practices of 20th-century education, not because it "didn't work," but because of its implications. Fred Skinner's dream of an effective, nonelitist, noncompetitive, positively reinforcing sys-

[5] *The analysis of behavior: A program for self-instruction.* New York: McGraw-Hill, 1961.

tem for students of all ages and in every walk of life was not to be made real within his lifetime, to his oft-expressed regret. He left us with a goal, however, towards which we all can strive.

These are my main reasons for saying "thank you" to Fred Skinner here; the readers of this journal will have others. Now I must add two postscripts. The first is a quotation. On the flyleaf of my copy of *Science and Human Behavior* is the following inscription:

> Dear Fred,
>
> If this had been the 18th Century, I could have written a dedication which would have made things clear to everyone. As it is, I can only speak *a deux*. "To F. S. Keller" means "Thanks for many things"—in the late twenties for the only breath of behaviorism at Harvard—in the thirties for never-failing and much-needed reinforcement (what the layman, poor fellow, can only call faith)—and in the forties for showing how a science of behavior can be taught. S & H B could be written only because K & S came first.
>
> Here's to the fifties and the sixties!
>
> Burrhus
>
> February 1953

Rarely on life's stage does a distinguished actor perform without a distinguished supporting cast. Fred was no exception. Applause for a great performance must also be accorded to his wife, Yvonne (Eve, to most), to Julie (known to all of us), and to Deborah ("Debs"), "the little girl who was brought up in a box!" Each one in her own right is a star today, with a record of success, and each deserves our curtain call!

Fred S. Keller
Chapel Hill, North Carolina
August, 1990